REMARKS

The above amendments to the above-captioned application along with the following remarks are being submitted as a full and complete response to the Office Action dated February 16, 2006 (U.S. Patent Office Paper No. 0206). In view of the above amendments and the following remarks, the Examiner is respectfully requested to give due reconsideration to this application, to indicate the allowability of the claims, and to pass this case to issue.

Status of the Claims

As outlined above, claims 2-3 stand for consideration in this application, wherein claim 1 is being canceled without prejudice or disclaimer, while claims 2-3 are being amended to correct formal errors and to more particularly point out and distinctly claim the subject invention. All amendments to the application are fully supported therein. Applicant hereby submits that no new matter is being introduced into the application through the submission of this response.

Prior Art Rejections

The First and Second 35 U.S.C. §102(e) rejection

Claim 1 was rejected under 35 U.S.C. §102(e) as being anticipated by Adams et al. (US 6,649,132 B2). Claim 1 was also by rejected under 35 U.S.C. §102(e) as being anticipated by Willner et al. (US 2004/0048272 A1). As mentioned above, claim 1 is being cancelled, and therefore the rejections of claim 1 are moot.

The Third 35 U.S.C. §102(b) rejection

Claims 1-3 were rejected under 35 U.S.C. §102(b) as being anticipated by Gerion et al. (*J. Phys. Chem.*). As mentioned above, claim 1 is being cancelled, and therefore the rejection of claim 1 is moot.

Regarding claims 2-3, Applicants respectfully traverse the rejection of claims 2-3 for the reasons set forth below.

According to the M.P.E.P. §2131, a claim is anticipated under 35 U.S.C. §102 (a), (b), and (e) only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.

Claim 2

The Office Action contends that Gerion discloses a method comprising the steps of: modifying semiconductor nanoparticles (with a diameter of between 3 and 14 nm, Fig. 5) with oil-soluble materials (coating by TOPO/TOP, starting materials shown in Fig. 1) for surface modification (since the coating is on the surface of the nanoparticles); converting the oil-soluble materials for surface modification into water-soluble materials for surface modification at the interface between an organic solvent and water (last step shown in Fig. 1 the functional groups of thiol and phosphate "to tailor the nanocrystal surface functionality", or MPA-coated nanocrystals; and shifting the semiconductor nanoparticles from an organic phase to an aqueous phase by the conversion (since they are soluble in water). The Office Action further contends that Gerion discloses to "photobrighten" the nanoparticles by irradiation of aerated solutions, which encompasses the cited size-selective photoetching, thereby regulating particle sizes (since the solution is brightened, some particles are dissolved and relative monodisperse particles remain in solution) and monodispersing the semiconductor nanoparticles (since the solution is brightened). Applicants respectfully disagree.

The present invention as now recited in claim 2 provides that a method comprising the steps of modifying semiconductor nanoparticles with oil-soluble materials for surface modification; converting the oil-soluble materials for surface modification into water-soluble materials for surface modification at the interface between an organic solvent and water; shifting the semiconductor nanoparticles from an organic phase to an aqueous phase by the conversion; and subjecting the semiconductor nanoparticles, the surfaces of which have been modified with the water-soluble materials for surface modification, to size-selective photoetching, wherein the surface of the semiconductor nanoparticles is dissolved and peeled by the size-selective photoetching, and particle sizes of the semiconductor nanoparticles are regulated and the semiconductor nanoparticles are monodispersed by the dissolution. "Size-selective photoetching" is a chemical technique that attains monodispersed distribution of particle sizes by utilizing the oxidative dissolution of a metal chalcogenide semiconductor in the presence of dissolved oxygen by irradiation of light.

In contrast, Gerion merely shows in Fig. 1 that a surface material of a semiconductor nanoparticle is modified with a thiol compound and further reacted with silica so as to be water-soluble. Gerion merely shows that a continuous wave (CW) laser is irradiated to nanocrystals to photobrignten them and increase the fluorescence intensity by up to a factor

of 2 in the first stage of the illumination and then leaves off to a stable value. (p. 8868, B. Optical Characterization Section) Gerion says nothing about the irradiation by CW-laser to dissolve surface materials of nanoparticles. Rather, a CW laser in Gerion is used to increase the fluorescence intensity and compensate lower emission intensity of the nanocrystals.

Therefore, Gerion does not show every element recited in claim 2. Accordingly, claim 2 is not anticipated by Gerion.

Claim 3

Claim 3 has the substantially same features as those of claim 2 with respect to the step of subjecting the semiconductor nanoparticles, the surfaces of which have been modified with the water-soluble materials for surface modification, to size-selective photoetching. As such, the arguments set forth above are equally applicable here. Claim 2 being allowable, claim 3 must also be allowable.

35 U.S.C. §103(a) rejection

Claims 2-3 were rejected under 35 U.S.C. §103(a) as being allegedly unpatentable over Gerion in view of Torimoto et al (*J. Phys. Chem. B* 2001). This rejection is respectfully traversed for the reasons set forth below.

According to the Manual of Patent Examining Procedure (M.P.E.P. §2143),

> To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both not found in the prior art, not in the applicant's disclosure.

The Office Action contends that Gerion shows every element of claims 2-3 except that Gerion does not recognize that irradiating the aerated solution causes size-selective etching. The Office Action further contends that Torimoto teaches that size-selective photoetching is a useful technique for forming ultrasmall semiconductor nanoparticles, and that it would have been obvious to one of ordinary skill in the art to use size selective photoetching, thereby regulating particle sizes, monodispersing them, peeling and converting

the materials for surface modification in the method of Gerion because Torimoto teaches that it is a useful technique for forming small semiconductor nanoparticles. Applicants respectfully disagree.

The present invention is directed to a method of preparing semiconductor nanoparticles in an aqueous solution, because it is more suitable to apply size-photoetching to materials such as CdS and CdSe in an aqueous solution. (See page 2, line 23-28) Particularly, the present invention enables size-selective photoetching of CdSe because it is available to applying size-selective photoetching to nanoparticles of CdSe only in an aqueous solution (See page 10, lines 11-13). In the present invention as recited in claims 2-3, the oil-soluble materials on the surface of semiconductor nanoparticles are converted into water-soluble materials and the semiconductor nanoparticles are shifted from an organic phase to an aqueous phase before the semiconductor nanoparticles are subjected to size-selective photoetching. Thus, the water-soluble surfaces of the semiconductor nanoparticles are dissolved.

In contrast, Torimoto shows that the size-selective photoetching of the nanoparticles is performed, and then the surfaces of the nanoparticles are modified with thiophenol to prepare ultrasmall semiconductor nanoparticles. (p. 6838, Experimental Section) In Torimoto, semiconductor nanoparticles themselves are dissolved and peeled away.

As indicated by Torimoto, it is known that a size-selective photoetching is useful means for preparing nanoparticles, however, Torimoto does not explicitly or implicitly show or suggest that size-selective photoetching may be performed after the surfaces of the semiconductor nanoparticles are modified with oil-soluble materials and converting the oil-soluble materials into water-soluble materials, and consequently the water-soluble materials are dissolved and peeled away by the size-selective photoetching, as now recited in claims 2-3.

Furthermore, there is no suggestion or motivation to combine Torimoto with Gerion explicitly or implicitly in Torimoto or Gerion, or in the knowledge generally available to one of ordinary skill in the art at the time the invention was made to embody all the features of the invention as recited in claim 2. Accordingly, claim 2 is not obvious in view of all the prior art.

Obviousness Double Patenting Rejection

Claims 1-3 were rejected pursuant to the judicially-created doctrine of obviousness-type double patenting as being unpatentable over claims 1-9 of U. S. Patent No. 6,911,082. With respect to claim 1, the rejection is moot as set forth above.

Applicants have respectfully submitted on December 12, 2005 arguments against this obviousness-type double patenting rejection in a response to the Office Action dated August 12, 2005. However, the Examiner has rejected Claims 1-3 on the same basis without responding to Applicants' argument. Therefore, Applicants again respectfully submit the same arguments set forth in a prior response to the Office Action apply.

In contrast, the Sato '082 patent, referring to Figure 1 thereof, discloses an intermediate step involving TOP for obtaining multiple layers using ZnS and the like. In this regard, Claim 1 of the Sato '082 patent, from which Claims 2 through 9 therein ultimately depend, includes a step of coating the semiconductor nanoparticles in the layer to which the stabilized semiconductor nanoparticles have been transported with multiple layers.

In contrast, in accordance with the present invention, referring to Figure 1 of the above identified application, for example, the semiconductor nanoparticle surface-modifying material is converted, such as from TOP to MFA, and not for obtaining multiple layers, but as can be utilized for a later-performed photoetching. In this regard, it is respectfully submitted that Claims 1 through 3 of the above identified application do not recite such a multiple layer step as in the Sato '082 patent.

Therefore, it is respectfully submitted that the Claims 2-3 of the above identified application are not obvious over Claims 1 through 9 of the Sato '082 patent.

Withdrawal of the obviousness type double patenting rejection of Claims 2-3 of the above identified application over Claims 1 through 9 of the Sato '082 patent is respectfully requested.

Reconsideration and allowance of Claims 2 - 3 is respectfully requested.

Conclusion

In view of all the above, Applicants respectfully submit that certain clear and distinct differences as discussed exist between the present invention as now claimed and the prior art references upon which the rejections in the Office Action rely. These differences are more than sufficient that the present invention as now claimed would not have been anticipated nor rendered obvious given the prior art. Rather, the present invention as a whole is distinguishable, and thereby allowable over the prior art.

Favorable reconsideration of this application as amended is respectfully solicited. Should there be any outstanding issues requiring discussion that would further the prosecution and allowance of the above-captioned application, the Examiner is invited to contact the Applicant's undersigned representative at the address and phone number indicated below.

Respectfully submitted,

Stanley P. Fisher
Registration Number 24,344

Juan Carlos A. Marquez
Registration Number 34,072

REED SMITH LLP
3110 Fairview Park Drive
Suite 1400
Falls Church, Virginia 22042
(703) 641-4200

May 31, 2006

JCM/YM